EXPERIENCES OF AFRICAN AMERICAN MALE ENGINEERING STUDENTS: A QUALITATIVE ANALYSIS

BY

COURTNEY B. SANDERS

THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Science in Educational Organization and Leadership
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2010

Urbana, Illinois

Master's Committee:

Assistant Professor Lorenzo D. Baber, Chair
Professor Debra Bragg
Assistant Professor Timothy Reese Cain

Abstract

Prior to the 1970s, African Americans were essentially invisible in the science and engineering academic and professional communities (Babco, 2001a). The few who did earn degrees in these fields, obtained them primarily from historically Black colleges and universities (HBCUs), and these institutions also served as the primary employer for these graduates in science and engineering (Hines, 1997; Babco, 2001a, 2001b). Since the 1970s, African Americans have made considerable progress, but still are not on a level playing field with White males in terms of opportunities for preparation of science and engineering careers or for employment and advancement in those careers. The purpose of this study was to explore second and third-year African American male engineering students' perceptions and examine what experiences have contributed to their access to and persistence in engineering.

A qualitative research design was employed to gather data necessary to answer the research questions. Eight second and third-year African American male engineering students from Research University (pseudonym) participated in interviews with the researcher. The data from the interviews was used to consider the themes that emerged from the participants.

The findings from this study suggest that African American male engineering students at Research University have specific experiences that influence their persistence and academic achievement. Themes identified from the interview data include: (1) pre-college experiences; (2) participation in academic and social networks; (3) institutional programming and organizational support; (4) personal accountability and motivation; and (5) goals outside of engineering. As a result of this research, several future implications are highlighted. These include acknowledging the value of diversity, continued support through organizations, and increased knowledge of best practices.

Dedicated to my loving and supportive parents, Lorenzo and Victoria.

Acknowledgements

This project would not have been possible without the support of many people. I would like to thank my thesis advisor, Dr. Lorenzo Baber, for his guidance and support in helping me to complete this endeavor. I also wish to thank my other committee members, Dr. Debra Bragg and Dr. Timothy Cain for their encouragement throughout this experience.

I am grateful for the support of my colleagues who sustained me and cheered me on throughout this process. Julia Panke Makela, for your knowledge, assistance, and countless hours spent reading and editing my drafts, and for your numerous, invaluable resources without which I could not have completed this work. Additionally, to Latorria Griffith, for your friendship, understanding, and support both personally and academically.

I would like to convey my special appreciation to the students of Research University who participated in this study. I am grateful to these remarkable men, who took the time to share their experiences and perceptions with me. Without you, this project would have been impossible.

Many great thanks to George Richards III, for your constant support, understanding, and for helping me to keep sight of my goals even during the difficult times. Finally, I would like to express my deepest gratitude for the encouragement, love, and guidance that I received from my family. Thank you to my brothers, Nathaniel and Grant, for making me laugh and for helping take my mind off of work when I needed a break. Thank you to my mother, Victoria, for your wisdom, insight, and for being the example that I try to follow. Thank you to my father, Lorenzo, for always telling me to dream big, set goals for myself, and for reminding me that I can accomplish anything that I set my mind to.

Table of Contents

Chapter 1

Introduction and Overview

Prior to the 1970s, African Americans were essentially invisible in the science and engineering academic and professional communities (Babco, 2001a). The few who did earn degrees in these fields, obtained them primarily from historically Black colleges and universities (HBCUs), and these institutions also served as the primary employer for these graduates in science and engineering (Hines, 1997; Babco, 2001a, 2001b). Since the 1970s, African Americans have made considerable progress, but still are not on a level playing field with White males in terms of opportunities for preparation of science and engineering careers or for employment and advancement in those careers.

According to the National Science Foundation (2006), in 2004, African Americans earned 8.4% of all bachelor's degrees in science and engineering disciplines, a 1.3% increase since 1995. In terms of gender differences, African American females earned 10.7% of the bachelor's degrees awarded to females in science and engineering. On the contrary, African American males accounted for 6.1% of the bachelor's degrees in science and engineering awarded to males in 2004. This is in comparison to White males who earned 66.9% of science and engineering degrees awarded to males in 2004 and White females who earned 63.2% of science and engineering degrees awarded to females in 2004. While the numbers of African American male bachelor degree holders have increased slightly over this decade, the statistics demonstrate that African American males remain underrepresented among students who pursue and earn science and engineering degrees, especially when compared not only to White students, but to their African American female counterparts.

For decades, scholars have studied the dwindling numbers of African American males on college campuses, mainly focusing on how cultural and environmental disadvantages impact educational experiences of Black males (e.g., Cuyjet, et al. 2006; Davis, 1994; Moore, 2006). A few scholars (e.g., Hines, 1997; Maton & Hrabowski, 2004; Moore, 2006) have explored other factors that influence their academic majors and career choices, which include pre-college interests, skills, and academic preparation. The lack of ethnic minorities in undergraduate and graduate degree programs in all science, technology, engineering, and math (STEM) fields has been noted in both scientific and popular literature (Hines, 1997; Hrabowski & Pearson, 1993; Moore, Madison-Colmore, & Smith, 2003; Powell, 1990). Yet, there remains a shortage of research that has identified important factors influencing African American males' decisions to pursue engineering as an academic major and their persistence in those majors throughout their duration at an institution.

With continuous advancements in technology, sufficient preparation in science and mathematics is becoming a necessity for entry into the workforce in today's information and knowledge-based society (Hrabowski, 2003; Moore, 2006). Although the need for high-tech skills constantly increases, evidence suggests that colleges and universities are not producing adequate numbers of engineers to fulfill anticipated positions (Babco, 2001a, 2001b; Moore, 2006), particularly for nontraditional populations (e.g., women, African Americans, Latinos, and Native Americans; Moore, 2006; Sondgeroth & Stough, 1992). In order for the United States to move forward as a technologically advanced nation, businesses and organizations must continuously draw and retain new, young talent with fresh perspectives. The United States, therefore, should have an interest in the need to direct resources into initiatives that draw and retain underrepresented populations, such as African American males, to engineering fields.

Statement of the Problem

In order to address the issue of the lack of African American male students in undergraduate engineering programs, it is essential to first identify the factors that contribute to the persistence of African American male students currently in engineering programs. There is a need to further understand what encourages African American males to choose engineering majors and to persist in engineering academic programs before creating programs or initiatives to promote or advance the participation of this group of students in engineering or engineering-related fields. Once these instrumental factors have been recognized, practical action plans for recruitment and retention strategies for African American male engineering students can be constructed.

Purpose of the Study

Considering the importance of improving the educational status of African American males in STEM fields, but also in colleges and universities in general, this study explored the attitudes, perceptions, and experiences of second and third-year African American males majoring in engineering at a large, predominantly White, research institution. This study considered the personal experiences of African American male students and examined what factors, both institutional (e.g. faculty-student relationships, academic support) and non-institutional (e.g. family encouragement, peer networks, pre-college aspirations) have contributed to their access to and persistence in engineering. This study not only pinpointed these factors, but also indicated what meaning students gave to them and to what they credit their access to and persistence in engineering.

Research Questions

This study explored the following questions about second and third-year African American male engineering students:

- What pre-college factors do participants perceive to have influenced their pursuit of engineering majors?
- To what extent do established relationships with faculty and peers and support and encouragement from these sources contribute to participants' persistence?
- To what extent do relationships with familial networks, and support and encouragement from these sources, contribute to the persistence of participants?
- How do participants perceive their academic experiences, being one of few African American males in a predominantly White college of engineering?
- How does participation (or lack of) in institutional or other programming geared towards engineering students or towards the academic support of minority students have an effect on participants' persistence?

Significance of the Study

Identifying the factors that have had a positive impact on enrollment and success of second and third-year African American male students in the engineering program in this study can provide educators and administrators of the university attended by the participants (and other universities), as well as parents, family, and mentors of potential students, with the insights regarding what works and what does not for this group of students. It will provide greater knowledge of how these students have been able to persist to their second or third year of their program and how they can be supported to persist.

This research may also provide an improved understanding of what programs or initiatives have been beneficial for these particular students, which could inform the allocation of various resources that could make a difference. This includes funding to programs that have been

shown to be important in providing positive student outcomes, administrative commitment to a diverse student body, and the devotion of faculty and staff's time and energy to programs and events.

Definition of Terms

To understand this study, two central terms must be defined, *persistence* and *African American.* The term *persistence* is defined in the context of this study as students who have successfully completed at least one year of engineering courses (freshman year) at the university and who have re-enrolled as engineering majors for a second or third year. The term *African American* is used interchangeably with the word *Black* in this study, and refers to students who self-identify as being African American or Black.

Delimitations

Delimitations are factors that narrow the scope of the study and restrict researchers from claiming that their findings are true for other populations in other settings (Creswell, 2003). This study focuses on the perceptions of African American male engineering students at one specific university. This study cannot account for the perceptions of all African American male engineering students, nor can it account for the perceptions of other students at this particular university. While the experiences of White, Latino, Asian, Native American, and female engineering students at this university are also important, this study aims to facilitate the discovery and investigation of perceptions specific to African American male engineering students due to their underrepresentation in engineering fields. This study does not include students who have not persisted in engineering. While the experiences of these students are

significant and could shed light on why certain students do not persist, this study focuses on persisting students and what experiences or characteristics contribute to their persistence in engineering. Additionally, the findings from this study may not be attributed to all African American male engineering students as qualitative research is innately contextual with the individual researcher acting as an instrument of data collection (Bogdan & Biklen, 2007; Creswell, 2003). As with any qualitative study, the findings are not generalizable (Creswell, 2003) as particular samples are purposefully selected to provide specific insight into the phenomena being researched. Caution is encouraged in the consideration of findings, particularly regarding how the findings may be related to different student groups and institutional environments. Readers should carefully consider these contexts in their application findings.

Limitations

Although students were able to provide their personal accounts, which allowed for the exploration of student perceptions, the converse limitation is the students' control over the extent of information that was shared. Participant descriptions of their experiences as African American male students in engineering innately come with respondent bias. Since the students were aware of the target research population and had a general idea of the research topic, they may have felt obligated to share certain experiences that they ordinarily would not have or they may have chosen to share more of their negative experiences in the program which might alter some of the findings.

Another limitation of qualitative in-person interviews is the constraint of students responding to questions and sharing their experiences outside of their natural settings. Interviews were conducted in library study rooms and efforts were made to ease the participants into the

interview questions through light introductory conversation, but the students still might have felt nervous or uncomfortable in a personal one-on-one setting which could have had an affect on their responses. This study was also limited by varying levels of the participants' articulation abilities. Some students are naturally more capable of articulating their thoughts, feelings, ideas, and experiences than other students, which could lead to varying findings.

Since participants were initially recruited through an organization, selection bias likely prohibited certain students from hearing about the study and participating. There could have been additional interested students in the College of Engineering who were overlooked because they were not affiliated with the student organization or did not have relationships with other participants who could have mentioned the study. Since the university and the College of Engineering in this study are highly selective (see *Methods* section for detailed descriptions), it is meaningful to consider that the students in this study have already accomplished something just by being admitted. Additionally, all of the participants are students in an engineering program at a large, predominantly White, research institution. The experiences of similar students at other types of colleges and universities may be different.

Reflexivity

As an African American woman, prior thoughts, experiences, and knowledge that the researcher holds, present plausible cause for bias. Recognition of these preconceived notions and self-reflection throughout the interview and data analysis phases counter some of these researcher biases (Creswell, 2003). The racial and ethnic background of the researcher may have also presented an advantage in this study, because the participants may have felt more

comfortable sharing some of their experiences with someone who is African American, as opposed to someone of a different race or ethnicity.

Chapter 2

Literature Review

Previous research suggests that enrollment and degree completion rates of African American male students continue to fall behind those of White students and African American female students (Leppel, 2002; United States Department of Education, 2007). According to the U.S. Department of Education (2007), between 1976 and 2004 the number of both males and females of each racial/ethnic group increased. However, by 1980 the percentage of females enrolled as undergraduates surpassed that of males, with the largest gender disparity shown between African American students. By 2004, African American females comprised 64 percent of the total African American undergraduate enrollment. Similar findings have been shown regarding persistence and degree attainment of African American males and females (Leppel, 2002; Peter & Horn, 2005). By 2001, African American women earned two-thirds of postsecondary degrees (associate's and bachelor's degrees) that were awarded to African American students (Peter & Horn, 2005). For these reasons, enrollment and persistence of Black males are issues of concern in the United States' higher education system.

Past research suggests that the race and gender gap for African American males in STEM fields exists for various reasons, including: inadequate secondary education facilities and resources; poor academic performance in science and mathematics; low expectations from teachers and school counselors regarding students' academic abilities; inadequate parental and familial support; and a dearth of positive mentors to promote their interests in science, mathematics, and engineering (Hrabowski, 2003; Moore, et al., 2003; Hrabowski & Pearson, 1993).

Disparities in African American males' academic achievement at the postsecondary level have been attributed to many sources. Moore, et al. (2003) contend that the future of Black males, in large part, is predetermined by their academic performance and experiences at different levels of school (i.e. elementary, secondary, and postsecondary) because each school level serves as a feeder to the next. The early years of education are viewed as particularly critical in preparing for college, particularly in math, science and engineering majors (Moore, 2006; Rascoe & Atwater, 2005; Moore, et al., 2003; Hrabowski & Pearson, 1993). Regardless of the reasons, the fact remains that the disparities exist.

High-Achieving African American Males

Since much of the research regarding African American males in collegiate environments focuses on underachievement, which can unintentionally perpetuate lower expectations for Black academic success, it is essential to shed light on the academic, social, and racial experiences of high-achieving Black males (Bonner, 2001; Fries-Britt, 1998; Harper, 2005). Studies of high-achieving African American male students provide insight into how those who are academically successful in collegiate environments manage and maintain their levels of achievement given the various issues that research shows Black males face, including racism, stereotyping, institution incompatibility, and the shortage of same-race faculty and staff whom the student can rely on for support and mentoring (Harper, 2005).

Previous research on the student outcomes of African Americans at predominantly White colleges and universities suggests that student academic performance is affected by the quality of life that these students experienced at their respective institutions (Allen, 1992; Bonner, 2001). Previous studies also show that a university's procedures and resources, levels of academic

completion, established friend-support networks, and relationships maintained with faculty are contributing factors to this group of students' success at an institution. Bonner (2001) explains that the issues that face school-age gifted students may carry over into their postsecondary school experiences, and it is therefore important to pay attention to these issues at the college level. It is crucial to look at these issues for African American males because research has shown that this group of students has a different set of development needs than White students and African American females (Bonner, 2001).

A few previous research studies have shed light on the experiences of academically talented African American male undergraduate students and how their relationships with their respective institutions have supported their academic achievement. Fries-Britt's (1998) qualitative study of 12 senior-year college students enrolled in the Meyerhoff Program (a merit-based scholarship program for students in math, science, and engineering) at a predominantly White institution, sought to shed light on academic, social, and racial experiences of high-achieving Black males. The interview questions focused around three broad areas: academic experiences in and outside of the classroom, social interactions and relationships with peers and faculty, and experiences in and perceptions of a "race specific" program. Fries-Britt found that the students in this study did not have much exposure to or interaction with other academically successful Black students in high school, which seems to correlate with other reported experiences of high-achieving Blacks. For all of the students, their experience in the Meyerhoff program signified the first time that they were surrounded by a large number of high-achieving Blacks who were also striving towards further academic success. This study points to the importance of "race-specific" programs in providing culturally supportive environments and promoting attitudes of success.

Harper's (2005) study of high-achieving African American males found that active engagement in multiple learning venues significantly enhanced the undergraduate experience for this group of students. High achievers in this study identified a set of practical skills that they gained from leadership opportunities in student organizations and through meaningful interactions with other student leaders, advisors, and administrators. These included managing time balancing multiple tasks simultaneously; learning to work with people from various cultural backgrounds; working effectively on teams; delegating tasks to others; and communicating comfortably to individuals, small groups, and large audiences. The participants believed that active out-of-class engagement positively affected their academic work.

Pre-College/K-12 Factors Influencing Persistence

Strong science and mathematic interest and ability.

Many researchers have stressed the importance of interests in selecting an academic major, particularly in the STEM fields, showing a close link between interests and career choice (Hrabowski & Pearson, 1993; Moore, 2006). Research also suggests that the interests a person holds are often the products of environment, upbringing, education, and cultural tradition (Hrabowski, 2003; Maton & Hrabowski, 2004; Moore, 2006; Moore, et al., 2003). Researchers and social scientists have examined the factors that contribute to students' interests in engineering, and consequently have found that students' desires to pursue engineering majors are strongly tied to their interests in science, technology, mathematics, and engineering. In Moore's (2006) study of African American male college students in engineering, he found that many of the students in his study made reference to their interests and how these interests shaped their decisions to choose engineering as an academic major and career choice. Many participants

shared experiences of developing an interest in engineering or mathematics as children, which further developed and led them to pursue engineering upon reaching the collegiate level.

According to Powell (1990), the selection of college majors and professional careers is arrived at differently by African American and White students, and this can possibly be attributed to links between self-concept and academic achievement which develop from childhood through adolescence. African Americans are overrepresented in occupations such as education, the humanities, and the social sciences when compared to occupations related more towards math and science. Powell (1990) notes that one possible explanation is that African Americans tend to choose careers in which they have had contact with successful role models or where they perceive greater opportunities for employment. Greatly insufficient career guidance and preparation has also been attributed to the underrepresentation of African American students in science and mathematics programs. Also, many African American high school students receive career guidance from their peers and parents, many of whom have not attended college, and often provide inaccurate career advice and information (Powell, 1990).

Powell (1990) provides a "conceptual framework for understanding African American students' avoidance of mathematics and science careers" which she describes as a "learned helplessness" that stems from cultural expectations of failure which become self-fulfilling prophesies (p. 294). Continuous educational experiences with failure seem to cause many African Americans students to fall prey to learned helplessness in which they view their academic failure as inevitable and the result of personal faults. As a result, these students give up, believing that they will not be able to succeed in science and mathematics. By the time they reach college, they stray away from mathematics, thinking that further failure can be avoided by staying away from the subject (Powell, 1990).

It is also clear that in order for students to have success in engineering during college, they must have strong skills in science and mathematics (Maton & Hrabowski, 2004; Moore, 2006; Moore, et al., 2003). Participants in Moore's (2006) study recognized early in school that math was something at which they were good, and although it may not have been an interest for all of them initially, the acknowledgment that they had a strong ability in math had a heavy influence in their choice of major and career trajectory.

Previous research shows that African American males have lower standardized test scores, higher dropout rates, lower participation in non-athletic extracurricular activities, and lower enrollment in advanced courses than do their White counterparts or Black females (Hrabowski, 2003; Moore, 2006; Moore, et al., 2003; Rascoe & Atwater, 2004). Sufficient academic preparation in science and math is a critical factor to academic success in engineering, as well as is attaining basic problem-solving and analytical skills in those demanding courses (Maton & Hrabowski, 2004; Moore, 2006; Moore, et al., 2003). According to Moore (2006), it is therefore, necessary for public schools to offer academic courses and experiences in which all students, African American students in particular, can gain the skills that are crucial to academic achievement in engineering. Although African American males' quality of school experiences largely determines their academic success and career paths, unfortunately, many African Americans often attend public schools that are failing based on academic or graduation standards (Moore, 2006). In many of these schools, these students are often dissuaded from taking advanced science and math courses, and teachers, school counselors, and parents repeatedly eliminate various career options throughout their primary, secondary, and postsecondary education (Moore, 2006; Moore, et al., 2003; Powell, 1990).

Family support and encouragement.

Another key element in positive academic outcomes for African American students in science and mathematics is family support and encouragement (Hrabowski, 2003; Moore, 2006; Smith & Hausafus, 1998). According to Moore (2006), "African American parents have the capability to positively influence their children… [and] …instill in their African American sons, at an early age, the importance of education and their expectations of academic excellence" (p. 262). Further, parental involvement, parenting style, and parental expectations all have an effect on a child's education, and the encouragement from an adult to try science and math at an early age and continue in advanced courses can help students to see themselves in science or mathematics related professions in the future (Smith & Hausafus, 1998). The more that parents reinforce their expectations, the more African American males are likely to commit to school. A combination of parents' firmness, encouragement, support, and continuous follow-up, is valuable in aiding African American males to find their way through various levels of the educational pipeline (Moore, 2006).

College Factors Influencing Persistence

Black males are not effectively recruited and retained at institutions of higher education, and more focus should be directed at persisting Black males in order to explore how their educational environment aids in fostering their persistence (Davis, 1994; Moore, 2006). The economic and social problems facing African American males have made their experiences in college major causes of concern for numerous higher education institutions (Davis, 1994). A few factors that affect African American student performance differently than White college students include, "a perceived lack of positive social support" and "perceived discrimination on the part

of professors, administrators, and peers" (Davis, 2005, pp. 621). Studies of Black students' experiences at predominantly White institutions (PWIs) show that students attending these campuses report higher occurrences of racial discrimination than Black students attending historically Black colleges and universities (HBCUs; Allen, 1992). Along with poor race relations, this group of students may also face negative experiences with social integration and academic achievement. This is significant to attainment and persistence due to the link between academic achievement and student engagement in and satisfaction with college (Allen, 1992; Davis, 1994).

As in larger society, race is a prominent and persisting force for African American males in higher education. The academic and social experiences of African American males are often tainted by racism, discrimination, and negative social stigmas, particularly at predominantly White institutions (Davis, 1994; Moore, et al., 2003). Images of inferiority are communicated to Black males at an early age, and some social scientists believe that these messages make it difficult for Black males to adjust in life as well as in social institutions such as higher and postsecondary education (Moore, et al., 2003). Further, many researchers and scholars in higher education have found that continuous exposure to these negatives attitudes has a serious negative effect on African American male students' social and emotional growth as well as on persistence and graduation rates at PWIs (Moore, et al., 2003)

Importance of persistence during the sophomore year and beyond.

Recent studies have discussed the importance of student engagement and support during the critical second (or sophomore) year of college in fostering persistence (Gahagan & Stuart Hunter, 2006; Graunke & Woosley, 2005; Sanchez-Leguelinel, 2008; Schreiner & Pattengale, 2000). Many institutions dedicate numerous resources and efforts to the freshmen year

experience through academic support programs, counseling, mentoring, and the development of academic support programs. However, many of these programs are decreased during the second year, leaving sophomores feeling abandoned by the institution (Sanchez-Leguelinel, 2008). While these students are trying to commit to a major field of study and are struggling with intensifying curriculum, they also have fewer opportunities to meet with professors who are more likely to focus on the development and advisement of junior and senior students (Schreiner & Pattengale, 2000). The struggles students face during the second year of college have been credited to the high level of attrition that occurs during the sophomore to junior year transition (Sanchez-Leguelinel, 2008).

According to Bowen, Chingos, and McPherson (2009), "nearly half (44 percent) of all withdrawals occur after the second year" (p. 35). The researchers point out that this finding is contrary to those who emphasize the importance of the first few semesters of college. Although they acknowledge the importance of students' experiences during their first few semesters at a university and the significance of institutional efforts promoting retention during the freshman year, Bowen et al. contend that it is essential to continue retention initiatives throughout a student's postsecondary education.

The literature provides considerable evidence to confirm the needs of second-year students and provides a starting point for developing services focused on helping these students make it through the difficult areas that are significant to success and retention (Graunke & Woosley, 2005; Sanchez-Leguelinel, 2008; Schreiner & Pattengale, 2000). Educators and researchers should pay close attention to students' second year because this is the year in which students make many of the decisions that help them succeed in following years such as

narrowing their career options, refining their sense of purpose, and declaring their majors (Tobolowksy, 2008).

While research is currently lacking on the junior or third-year, the literature on the sophomore year confirms that the middle years are important and are a crucial time for college students that can help determine their future at an institution. It is critical to focus on these often overlooked years in order to gain insight into students' experiences and how they affect persistence and success at an institution.

Enrollment and persistence in STEM fields.

Existing literature confirms that persistence plays an essential role in the academic success of African American males in engineering majors (Hrabowski & Pearson, 1993; Moore, et al., 2003; Sondgeroth & Stough, 1992). According to Moore, et al. (2003), despite challenges that they may face, persistent students seem to possess innate characteristics that allow them to manage and persist in harsh and unsupportive academic environments. This is not to say that persistent students are unaffected by these hostile experiences, but rather that non-persistent students are more inclined to let negative experiences, attitudes, and perceptions hinder their academic performance and goals.

Quality of educational environment.

Many studies suggest that support at an institution is one of the integral parts for persistence and achievement of African American males in colleges and universities. Research maintains that when African American men participate in higher education and well-organized support systems are established to promote achievement, these students have been successful (Hrabowski, 2003; LaVant, Anderson, & Tiggs, 1997; Maton & Hrabowski, 2004; Moore, 2006). Previous research also suggests that in order to retain minority students, institutions must

be responsive in their attempts to offer nurturing and supportive environments, and programs must be developed and implemented to create an immediate connection between students and university personnel soon after they arrive at an institution. Some research also points to the role of mentoring as having the potential to assist African American males in negotiating the many details of the higher education pipeline (LaVant, et al., 1997; Spradley, 2001).

Bonner's (2001) case study of two African American male college students (one at a PWI, the other attending an HBCU) discusses the importance of relationships with faculty and relationships with peers. Both students in Bonner's study of gifted African American male college students had valuable relationships with their peers that reinforced their academic achievement and showed them how their respective institution supported them academically. These students benefited academically and socially from their relationships with peers at their universities. This study suggests that peer relationships may expose students to a social network of other peers who are focused on achievement, which in turn creates and reinforces higher aspirations. According to Bowen et al. (2009), students learn from each other and being surrounded by highly capable peers improves the learning environment and promotes positive educational outcomes, including graduation from an institution.

Bonner's study also revealed that relationships established between faculty and students are perhaps the most significant factors contributing to students' persistence. The Black male from a PWI that Bonner studied perceived that the university he attended met his expectations in terms of in-class needs, but his encounters with faculty outside of class seemed to be very limited or non-existent. Although the student was academically successful, significant, positive interactions with faculty outside of the classroom might have improved his experience and his academic development (Bonner, 2001).

Research suggests that it is often difficult to integrate African American men into campus life, though integration may be assisted by a formal mentoring process (LaVant, et al., 1997). This research provides evidence that supports the perception that Black faculty presence provides optimistic views regarding research and academic careers for African American students. It is also suggested that close relationships between students and mentors contribute to students' positive characteristics.

This leads to the impact of mentoring African American males in higher education. LaVant, et al. (1997) recognize that students arrive at colleges with different characteristics, including family backgrounds, academic abilities, pre-college educational achievements, and various other personal attributes. Some African American male students enter college socially, economically, and educationally disadvantaged; integrating these students into the social framework of the institution (e.g., through student organizations or minority leadership programs) increases their chances of persistence. It is significant for students to become involved in various campus activities and form a connection with the institution that they attend, because students who connect with their institution and have relationships with peers and faculty are more likely to persist and graduate from the institution (LaVant, et al., 1997).

Strong academic guidance, coupled with taking advanced courses has been shown as effective in increasing educational aspirations for students in general and for African Americans in particular (Maton & Hrabowski, 2004; Moore, 2006). Social scientists have also recognized that participation in special programs (e.g., summer retreats, pre-college initiatives) that emphasize technology, science, engineering, and mathematics can also increase students' interests in these areas (Fries-Britt, 1998; Moore, 2006).

Various foundations and governmental agencies have begun to help colleges and universities with their efforts to produce more scientists, mathematicians, and engineers (Moore, et al., 2003). They provide funds to aid universities in developing initiatives to address the underrepresentation of women and minorities in engineering and other science-related majors (Hines, 1997). Many professional organizations have also been established to help remedy these same issues and these organizations provide various services including, mentoring, scholarships, and internships to outreach programs. This has helped the enrollment in STEM fields, but the numbers of African Americans (particularly males) still remain low in comparison to White students (Hines, 1997; Moore, et al., 2003).

Conclusions: Literature Review

Based on past literature, we know that African American male students are behind White and African American female students in terms of enrollment and degree completion rates (Leppel, 2002; United States Department of Education, 2007). There is also a race and gender gap in STEM fields for African American males that researchers attribute to multiple reasons. While many studies have focused on African American male underachievement, scholars (e.g., Allen, 1992; Bonner, 20001; Fries-Britt, 1998; Harper, 2005) have also demonstrated the insight that can be gained from exploring the experiences of high-achieving African American male undergraduate students.

Both pre-college/K-12 and college factors influence persistence have been shown to influence persistence in STEM majors. Pre-college/K-12 factors include a strong science and mathematic interest and ability, and family support and encouragement. College factors include engagement and support during the sophomore year and beyond, and for African American

students in STEM fields specifically: innate characteristics that allow students to persevere in negative or unsupportive environments; supportive institutional environments; and relationships with peers and faculty.

What the past literature has not shown, however, are the intersections between persistence, the sophomore/junior years, high-achieving African American males, and minority participation in STEM academic majors. Researchers have deemed the sophomore year as a critical point in students' decisions to persist or not. It is an interesting component to consider when studying African American male STEM students. It will shed light on students who are currently in their sophomore (or second) year and those who have transitioned to their junior (or third) year and illustrate what factors have influenced these students during a fundamental time in their undergraduate career.

Conceptual Framework

Hrabowski and Maton (1995) describe factors that they have found to be consistent with existing research that are linked to student academic success in STEM programs. Hrabowski and Maton recognize that few African American college students persist and achieve in science, technology, engineering, and math programs, and their research focuses on enhancing the success of African American students in those fields. In trying to determine what can be done to support strong STEM course performance, persistence in STEM majors, and subsequent entrance to STEM graduate programs, Hrabowski and Maton have identified four sets of factors, including:

Academic and social integration.

Academic and social integration seems crucial to the success of African American STEM majors, including highly capable students. Black students are more likely than White or Asian students to experience social and academic isolation at PWIs and in science-related majors (Maton, Hrabowski, & Schmitt, 2000; Nettles, 1988). Interactions with faculty outside the classroom and mentoring relationships with faculty, including minority faculty, can decrease feelings of academic isolation and produce positive outcomes for students. Also, a group of high-ability Black peers can enhance academic and social support and reduce perceptions of racism, contributing to persistence and success (Hrabowski, 2003; Hrabowski & Maton, 1995; Maton & Hrabowski, 2004; Maton, Hrabowski, & Schmitt, 2000).

Knowledge and skill development.

Knowledge of the subject and skill development is also critical for student confidence and success. Participation in peer study groups has been shown to result in improved technical knowledge mastery and course performance for STEM students. Additionally, strong study habits, time management skills, analytic problem-solving capacity, and the motivation to use available department and university resources have been associated with positive outcomes, including subject-knowledge proficiency and performance (Hrabowski & Maton, 1995; Maton & Hrabowski, 2004; Maton, Hrabowski, & Schmitt, 2000).

Support and motivation.

Support and motivation are also connected to minority student success in STEM fields. Due to the rigor of courses in these fields and the attractiveness of other majors, additional support and motivational resources are a necessity. These include academically supportive peer networks, high faculty expectations, hands-on research experience, tutoring, involvement with

faculty, and emotional support during times of need (Hrabowski, 2003; Hrabowski & Maton, 1995; Maton & Hrabowski, 2004; Maton, Hrabowski, & Schmitt, 2000).

Monitoring and advising.

Finally, continuous monitoring and advising can help science and engineering students make intelligent academic decisions regarding their coursework, prepare for plans after graduation (i.e. work or graduate study), and avoid personal and academic problems. Consistent advising and feedback can help students gauge their strengths and weaknesses and avoid falling short due to a lack of counseling or support. It can also help ensure regular evaluation of students' academic and social situations, as well as early warning signs of any personal or academic problems (Hrabowski & Maton, 1995; Maton & Hrabowski, 2004; Maton, Hrabowski, & Schmitt, 2000).

Conclusions: Conceptual framework.

Maton, Hrabowski, and Schmitt (2000) contend that these sets of factors are significant and that "universities committed to supporting African American and other underrepresented minority students in [STEM] majors strive to create environments which help to ensure student success. When this commitment is not made, we lose qualified African American [STEM] students to other majors, or from higher education totally" (p. 632). The factors that Hrabowski and Maton (1995) propose for minority achievement in STEM fields are noteworthy and take into account a considerable amount of research. They also demonstrate a need for more research in terms of more specific student characteristics and student populations. In particular, exploring the predictors of success by gender, in particular African American males, may reveal some unique challenges for this population as well as additional factors that contribute to their success (i.e. persistence).

Chapter 3

Methods

This research study elicited second and third-year African American male students' perceptions of their pre-college experiences and their experiences while majoring in engineering at a predominantly White institution. This study explored the influences of institutional and non-institutional components on African American males' access to and persistence in engineering majors. Participants were asked questions in order to obtain their perspectives regarding experiences, encounters, and relationships that have aided or supported their choice in major and their persistence in their academic program. A greater understanding of the experiences of students who have been able to persist in engineering majors, can provide educators, administrators, families, and mentors with insight to improve persistence for African American males in engineering programs. Additionally, knowing more about successful students can help faculty and administrators to better strategize to increase access and persistence for this population of students.

This chapter provides an explanation of the method of inquiry and research design utilized in this study. The appropriateness for the selection of a qualitative phenomenological approach to research as it pertains to the purpose of this exploration is addressed. The research design presented will include a profile of the site for investigation, participants of the study, and procedures and methods for data collection. Additionally, this chapter will account for considerations regarding the protection of human subjects.

Research Design

A qualitative approach was used for this research because it allows the researcher to focus on specific people or events and emphasize understanding the meaning for participants in the study, of the situations, events, actions, and experiences they were involved with or engaged in (Maxwell, 2005). Researchers in a qualitative study do not seek to provide "the truth" with the data they collect, but rather, that their assertions are plausible given the data (Bogdan & Biklen, 2007, p. 26). The descriptive nature of qualitative research allows the researcher to provide data that can inform educators, especially as they create programming and interventions for African American male undergraduate students. According to Maxwell (2005), qualitative researchers usually study a relatively small number of individuals or situations, which allows them to understand the particular context within which the participants act, and the influence that this context has on their actions and experiences. In this qualitative approach, the researcher based claims on constructivist perspectives (i.e. the multiple meanings of individual experiences which are socially and historically constructed, with the intent of developing a theory or pattern) and collected open-ended, emerging data through interviews with the primary objective of developing themes from the data (Creswell, 2003; Manning & Stage, 2003). The research questions positioned the experiences and the perceptions of the participants at the core of study and aimed to collect information on what caused these students to major in engineering and what factors have enabled them to persist through their program successfully.

Institutional review board review.

The protection of human subjects is a critical issue when interviewing students. The researcher complied with all requirements identified for research involving human subjects by the Institutional Review Board (IRB) of the University of Illinois.

Study design overview.

A qualitative research approach was used to collect data for this study utilizing semi-structured interviews with research participants to gather information regarding their experiences, perceptions, and attitudes as African American males majoring in engineering. Claims are based on constructivist perspectives (i.e. the multiple meanings of individual experiences, meanings socially and historically constructed, with the intent of developing a theory or pattern) and the researcher collects open-ended, emerging data with the primary objective of developing themes from the data (Creswell, 2003; Manning & Stage, 2003). The interview questions in this study (see Appendix C) aim to collect information on what caused these students to major in engineering and what factors have enabled them to persist to their sophomore or junior year in their respective engineering programs.

Setting, population, and participants.

To maintain the confidentiality of the institution, the researcher has selected to use the reference "Research University (RU)" throughout the study. Research University is a large, research institution, with a predominantly White student population. The institution has roughly 40,000 students, approximately 10,000 of which are graduate students. The student population is 53% male and 47% female. The racial/ethnic breakdown is as follows: 62.01% White, 6% African American, 6% Latino/a, 12% Asian American, 0.29% Native American, 13.7% International students. Undergraduate admission is highly selective. In the 2007 freshmen class, students in the middle 50 percent had ACT scores between 26 and 31, and 55 percent ranked in the top 10 percent of their high school graduating class. It is important to note that the undergraduate engineering program is also selective and has been ranked as one of the nation's top engineering programs (U.S. News & World Report, 2009). Research University is a

residential campus located near a major city, which is the home for many of the university's students.

Eight African American male students from the university's college of engineering participated in this study (see Appendix D for participant demographics). The participants included three second-year students and five third-year students. The students' majors included industrial engineering; computer science; electrical engineering; mechanical engineering; chemical engineering; and nuclear, plasma, and radiological engineering.

Sampling.

Purposive convenience sampling was used for this qualitative investigation, in order to reach the desired specific group of students. Specifically, African American male second and third-year students with academic majors in engineering hold the key experiences to support this research. The researcher contacted a student organization for engineers and an administrator in the engineering department to help spread information to students about the study. Students were provided with the researcher's contact information, which allowed them to contact the researcher if they were interested in participating in the study. All participants were either second or third-year engineering majors with varying focuses in engineering. Eight interviews were conducted. This number was manageable for the scope of the study, but large enough to receive detailed feedback from each participant.

The president of the National Society of Black Engineers (NSBE; pronounced "nesbie") at the Midwest University was contacted to help the researcher gain participants for the study. The researcher requested the aid of this individual because this person has a direct connection to some students who self-identify as African American in the engineering department and has contact information for these students. The NSBE president sent a message (see Appendix A) to

students on the NSBE listserv, and those students who were interested in participating and met the study criteria (i.e. male engineering students in their second or third year and who self-identify as African American) were able to contact the researcher using information contained in the email.

Data Collection

The primary instrument in data collection is the researcher (Creswell, 2003). The role of the researcher is to collect data from the participants utilizing both verbal and non-verbal cues. The primary advantages of executing a qualitative study regarding data collection are the added benefits of setting a place for participants to report historical events as well as ensured researcher control of the interview questions (Creswell, 2003).

Interview procedures.

For this research, each interview was audio-taped and detailed interviewer notes were taken after proper consent from participants had been granted. Participants were provided with an informed consent form (see Appendix B), which explained the research, listed any possible risks associated with participation, and provided the researcher's contact information. Seven of the interviews were conducted in quiet, enclosed study rooms in a library on campus, while the eighth took place in an empty classroom in a campus building. Interviews were scheduled to last approximately one hour, with actual times ranging from approximately 45 minutes to one and a half hours. At the beginning of each interview, participants were asked to provide demographic information for the study, including their year in school and their engineering focus (e.g., chemical, electrical, etc.). Every effort was made to protect the confidentiality and anonymity of participants.

Each interview was semi-structured with thirteen questions, with room allowed for the participants to add their thoughts, ideas, and stories, to aid them in accurately articulating perceptions of their experiences. Each student was also given the opportunity to provide additional information at the end of the interview about their experiences that was not provided in their answers to other questions throughout the interview.

Data Analysis

Creswell (2003) contends that data analysis is an ongoing process that involves continual reflection about the data, asking analytical questions, and writing memos throughout a qualitative study. Qualitative data analysis requires organizing, accounting for, and explaining data, and making sense of data in terms of participants' definitions of the situation, noting patterns, themes, categories, and regularities. During the data analysis process for this study, data was organized, reviewed repeatedly, and continually coded for themes pertaining to the participating students' experiences as majors in an engineering program.

Transcriptions.

Upon reviewing the interview recordings several times, the researcher became aware of the expressions conveyed by the students and decided to transcribe the interviews verbatim. Some liberties were taken to make sentences more fluid. Commas were used to indicate brief pauses in verbal flow and ellipses (i.e. three periods) were used to indicate a verbal break, usually when a participant was contemplating a question or collecting his thoughts. At times, phrases are contained within brackets to demonstrate the intent of the student. For example, some students pretended as if they were talking to a teacher or acting as if they were the teacher. This was indicated by words such as [acts as teacher] being placed immediately prior to a statement.

Brackets were also used to indicate words that were inserted by the researcher in order to provide the reader with clarification or signify moments that were spoken with a particular nuance or emphasis.

Coding.

Each transcript was read in its entirety several times and coding took place on an ongoing basis as interviews were transcribed by the researcher. Coding for this study involved organizing text data from the interviews into categories and then labeling these categories with a term to help bring meaning to the statement. The interviews were first coded into "organizational" categories, based on the broad areas that had been established prior to the interviews according to the research questions and the conceptual framework (Maxwell, 2005). According to Maxwell, the organizational categories serve as "bins" for sorting the data for further analysis. A second set of coding was applied and the data was separated into "substantive" categories which are primarily descriptive and include descriptions of participants' beliefs and concepts (Maxwell, 2005). Categories derived from participants' own words and concepts and developed through a close "open coding" of the data (Maxwell, 2005; Strauss & Corbin, 1998).

The themes were compiled and listed on a separate matrix and were grouped by the researcher into categories (Creswell, 2003) that related to the research questions and the conceptual framework, and additional categories of themes that seemed relevant to the participants' perceptions of their experiences.

Trustworthiness

In ensuring the trustworthiness of this study, the researcher utilized a few different strategies. Member checking, in which the participants provided verification in certain areas

throughout the analysis process, was employed. This included a dialogue regarding the researcher's interpretations of the participants' realties and meanings in order to confirm the truth value of the data. The same set of interview questions were asked of each participant and differences in follow-up questions were based upon the information that was shared by each participant. Also, clarification of possible researcher biases has been presented and explained to the reader (see *Limitations* section).

Chapter 4

Findings

Eight students at Midwest University were interviewed to gain insight into their perceptions as persisting African American males in engineering majors. The data from these interviews were used to address the following research questions about second and third-year African American male engineering students:

- What pre-college factors do participants perceive to have influenced their pursuit of engineering majors?
- To what extent do established relationships with faculty and peers and support and encouragement from these sources, contribute to participants' persistence?
- To what extent do relationships with familial networks, and support and encouragement from these sources, contribute to the persistence of participants?
- How do participants perceive their academic experiences, being one of few African American males in a predominantly White college of engineering?
- How does participation (or lack of) in institutional or other programming geared towards engineering students or towards the academic support of minority students have an effect on participants' persistence?

The interview data was explored through the lens of Maton and Hrabowski's conceptual framework, as presented in Chapter Three. This conceptual framework presented four sets of factors which have been deemed significant in enhancing STEM performance and persistence for African American college students. These factors include: (a) academic and social integration; (b) knowledge and skill development; (c) support and motivation; and (d) monitoring and advising (Hrabowski & Maton, 1995; Maton & Hrabowski, 2004; Maton, Hrabowski, & Schmitt, 2000).

Five sets of themes emerged from the interview data as contributors to persistence for the eight engineering participants in this study. These themes include: (a) pre-college experiences;

(b) participation in academic and social networks; (c) institutional programming and organizational support; (d) personal accountability and motivation; and (e) goals outside of engineering. The themes are presented in this chapter in categories, based on those that relate to the conceptual framework and the initial research questions, and those that have emerged as additional themes throughout the study that seem integral to the participants' experiences and persistence in engineering.

Theme One: Pre-college Experiences

The participants in this study conveyed a few factors that influenced their decisions to pursue engineering majors. These included an early interest in and knowledge of the subject area, and encouragement and support from their families. This finding is consistent with the pre-college/K-12 factors that were explored in the *Literature Review*, which included strong science and mathematic interest and ability, and family encouragement and support.

Early interest in and knowledge of the subject area.

All of the participants in the study expressed that they had an early interest in math and that they performed well in this subject area throughout their secondary education. Not all of the participants, however, mentioned that they had an early interest in science. Although the participants may have performed well in the subject area, some expressed that science was not a clear interest for them in comparison to math. A few participants mentioned experiences of having an interest in engineering or mathematics as children, which caused them to major in engineering once they reached college. As one participant described:

> I was always good in math and science… I knew I didn't want to do business because anybody can do business. Anybody can kind of manage and be ethical and do stuff like that, and I didn't want to do really anything else. I really wanted to do computer science

> because I did a couple of things with websites and I did a little developing in high school. A little bit of html and like programming, so I thought I'd do computer science.

Another participant described how he became interested in computer science and engineering at an early age:

> It was like back, I watched this movie called *Hackers* when I was like real, real young, and it was awesome. People, they were all hackers, and they would get into computers and [they] were changing all this stuff, and I thought that was something I wanted to do. I knew I wanted to end up getting into computers and stuff like that. And then once college time came around, I saw there was computer science, or the engineering department in general, and that's where I went to.

A third participant mentioned that he had always done well in science and math courses, but that teachers and a counselor in his high school encouraged him to use his abilities to pursue engineering:

> Umm, they [his teachers and counselor] actually brought it up. They were like, "Oh you're good at math, you're good at science. You should try engineering." Because I wanted to be an architect at first, and they were like, "No, you should try being in engineering." I didn't know what it was until I researched it a little.

Once this participant researched engineering, he realized that it was something he found interesting, and he decided to pursue it as a major.

These findings support Moore's (2006) study, in which participants referenced their early interest in engineering or mathematics, and how this shaped their decisions to choose engineering as an academic major and as a career choice. Although Maton and Hrabowski (2004) do not account for pre-college characteristics or experiences in the factors outlined in the *Conceptual Framework,* they do contend that students must have strong science and math skills in order to have success in engineering during college. The finding in the current study expands upon the *Conceptual Framework* and demonstrates the significance of science and mathematical abilities prior to entering an institutional environment.

Familial encouragement and support.

Although a few participants suggested that their families played a role in encouraging them while they were in college, it seemed that family members played a more integral role in guiding and supporting the students prior to them reaching the collegiate level. All of the participants explained that various family members have provided significant academic encouragement and support for them throughout their lives, particularly when it came to going to college and deciding to major in engineering. In response to whether he received encouragement from others to pursue engineering, one participant stated:

> My grandfather, and pretty much [from] my entire family. When I was little, my grandparents tried to make us all become doctors. You know, tried to get my brothers, sisters, cousins, everybody to be a doctor, everybody [to] grow up, make a lot of money, and be successful. And from the get-go, I didn't like that at all. I had no interest in medicine at all. So when they heard engineering, my parents didn't know much about it. My grandfather did a lot of research on it and became really interested in it. So after that, he was ecstatic, so he loved it… and my parents were for it. They usually support things that I do. They know that I'm, that I've though out the situation. They know that I'm not just jumping into something without looking into it, so they're supporting me with it too.

Another participant illustrated how his older brother influenced his academic decision:

> My oldest brother is also an engineer. He's a mechanical engineer. […] I just talked to him a lot about it and I've always been kind of into problem-solving. […] I mean he's just my older brother, so he used to always talk about engineering and stuff. It just seemed interesting to me.

Participants in this study had a broad view of family. When asked about familial experiences and encouragement or support, participants included experiences with immediate and extended family, close family friends, and other familial structures, such as church. One participant suggested that he received encouragement from his "church family" not only to pursue engineering, but college in general, because up until his junior year he didn't think he would be able to go to college because no one had ever mentioned it to him:

> Yeah, there was a lot of people at my church that really said, "Yeah, you should definitely think about going to college" and "you shouldn't just let it go to waste." Because I always knew that I wanted to go to college, but I didn't think it was possible for financial reasons and stuff. And they were like, "No, there's scholarships available and you should just try."

This student went on to mention that he applied for scholarships and received some that helped him to attend college. He also mentioned that he did not receive much encouragement from his immediate family to pursue college, because "a lot of them didn't really graduate [from] high school. They encouraged me to keep doing the stuff I was doing, but they didn't know anything about college. So they just did the best that they could."

Family support and encouragement are crucial elements in positive outcomes for African American students in science and mathematics fields (Hrabowski, 2003; Moore, 2006; Smith & Hausafus, 1998). Parental involvement in particular, that involves encouragement and reinforced expectations, is thought to positively influence African American students' educational experiences (Moore, 2006; Smith & Hausafus, 1998). Familial support is not mentioned in Hrabowski and Maton's (2004) factors. However, they do make a connection between other sources of support and motivation (e.g., peer networks and faculty relationships) and success in STEM fields. Previous research and the findings in the present study suggest the value of including family in a conceptual framework for African American STEM students.

Theme Two: Participation in Academic and Social Networks

Maton and Hrabowski (2004) contend that academic and social integration are critical to the success of African American STEM majors. They explain that Black students have a high probability of becoming academically and socially isolated on majority White campuses and in STEM majors. Maton and Hrabowski maintain that interactions with faculty outside of class and

relationships with high-ability peers (particularly Black peers) can reduce feelings of academic isolation and contribute to positive outcomes, including persistence.

Peer networks.

> A lot of my closest friends are engineers. One, because they know what I'm going through as far as schoolwork. But they also know what I'm going through as an African American or a minority on this campus. And they're pretty cool people too. And I surround myself with people who are going in a direction… people who are going in a direction that's upward. So that I can help them up and they can help me up.

This participant spoke about having African American and Latino engineering friends. His comments express the importance of having a group of friends who are driven and who are supportive, both academically and personally. Each of the participants in this study mentioned that engineering is a difficult major, and they expressed the value of having peers that they can do their homework with, ask for help when needed, provide help to others who may need it, and study for exams with. Another participant mentioned that it has been beneficial for him to develop relationships with other students in his specific major:

> I have like a small little clique of like eight. We're all in the same classes, I hang with them. […] I first met a couple of them when I was taking this other class. We always did homework, we always went to office hours on Saturdays […] so hanging out with them just slightly grew, just doing homework, going to office hours…

The statements from the participants highlight Maton and Hrabowski's (2004) findings related to the importance of having a group of high-ability Black peers who can enhance feelings of academic and social support and reduce students' perceptions of racism, which contributes to persistence and success (Hrabowski, 2003; Hrabowski & Maton, 1995; Maton, Hrabowski, & Schmitt, 2000). Fries-Britt (1998) also points to the significance of being surrounded by other high-achieving Black students who are striving towards academic success. She asserts that this group of peers can provide a culturally supportive environment and promotes attitudes of

success. Fries-Britt's finding is consistent with the ideas participants expressed in the aforementioned quotations.

Faculty and administrator support.

Two of the participants reported that they have experienced differential treatment from professors or engineering administrators as compared to their classmates of other racial or ethnic backgrounds. Although the students described these experiences as negative, they also explained that they were able to move beyond them and did not allow these off-putting encounters to discourage them or keep them from pursuing their goals in engineering. It is considerable to mention, however, that the majority of participants recounted positive interactions with either faculty or administrators that developed into valuable relationships. One participant explained how he took a semester off from the university, and when he was deciding whether or not to return, one administrator whom he had a previous connection with was very helpful:

> When I was going through [difficult times], she was one of the people who I was talking with. When I was saying, "Look, I'm probably just not coming back." she was like, "No. What do you need? Do you need a bike so you can get to class on time?" Because I told her that one of my classes was just really far from another one, and they were bending over backwards. I realized that, that was really cool. At an institution where a lot of the people either ain't trying to see you really go up or don't really care if you fall down, that at least one faculty member was working hard to get you through it. That's been a real, real good contact.

For this student, the ability to forge a relationship with an African American administrator was significant to his overall experience. He expressed that the support he received from this administrator was beneficial, and that having someone in the department who was encouraging, assisted him in his decision to return to the university.

Another participant mentioned his interactions with an administrator and two deans in the department: "There's a few faculty members that I actually keep in contact with. […] it's more of like a mentor type [of] friendship now. I've gotten to know them so much better." The

relationships he had with faculty members, influenced him to become a mentor in a program for incoming freshmen students. Other participants explained how they were able to develop connections with faculty members through recognition of similar experiences or goals they may have. For the students who were able to build ties with one or more professors or administrators, they expressed that it had a positive impact on their overall experience in engineering at the institution. They expressed feelings of support and guidance, which helped them to feel as though they better "fit" into the program.

This supports the *Conceptual Framework*, which states that mentoring relationships with faculty and interactions with faculty outside of the classroom can produce positive outcome for African American STEM students (Hrabowski, 2003; Hrabowski & Maton, 1995; Maton & Hrabowski, 2004; Maton, Hrabowski, & Schmitt, 2000). The findings in the current study also corroborate other research that has revealed that relationships between faculty and students contribute to students' achievement and persistence (Bonner, 2001; LaVant, et al. 1997).

Theme Three: Institutional Programming and Organizational Support

This section discusses how participation in institutional or other programming geared towards engineering or minority students has an effect on participants' persistence. As mentioned in the *Literature Review*, Fries-Britt (1998) asserted that for Black males in her study, "race-specific" programs provided culturally supportive environments and promoted attitudes of success.

Institutional summer program.

Several participants mentioned their involvement in a summer program for incoming, engineering students from underrepresented populations (e.g., minority students, students from

underrepresented high schools), which will be referred to in this study as "Engineering Summer Program" or "ESP." One participant described ESP:

> [ESP] is geared towards minority students. Just to give them, I guess, the right direction, and tell them everything that's available, because minorities don't have all this… just to let them know that there's programs out there and organizations out there that are willing to help. So freshman year, [I] got involved with those organizations and the study groups that we had during the program, we pretty much kept them [once the semester started] and were friends with everyone that was a part of [ESP], so we had those connections.

Another participant mentioned that the program helped him adjust to campus life and gain a better understanding of how life as an engineering student would be:

> But it was a good intro, a little bit scary, but a good intro to how like the whole college thing, coursework was going to be. Trying to handle a lot of stuff and time management… It was like trying to get us in the habit of studying for so many hours and stuff like that… One thing that's like one of the best things that came out of that program, was just like knowing a group of people before you came into college.

Other participants also mentioned that they were able to develop friendships with other minority engineering students that they still maintain in their second or third year at the university. Another participant described the friendships that he made during the program: "I really think that because of the [ESP] program, I've actually never felt like a number when I got here. So I already had, quote-unquote, 'a family' to turn to when I needed help." The relationships formed during ESP, allude to claims made in the conceptual framework for this study, that having relationships with minority peers who provide support, is integral to participants' success and persistence.

This theme further highlights the earlier findings regarding the importance of developing relationships with minority peers. Additionally, it supports previous research which suggests that in order to retain minority students, institutions must be responsive in their attempts to offer nurturing and supportive environments, and programs must be developed and implemented to create immediate connections between students and university personnel soon after they arrive at

an institution (LaVant, et al., 1997). Moore (2006) also contends that special programs (e.g., pre-college initiatives, summer retreats) that emphasize science, technology, engineering, and mathematics can also increase students' abilities and interests in these areas. Since ESP is an engineering pre-college program that is also geared towards underrepresented students, it is especially significant, and demonstrates the institution's and the College of Engineering's recognition of the needs of diverse students. Participants expressed that not only were they able to forge relationships early on with other minority engineering students, but their experiences in ESP also allowed them to feel as though they were integrated into both the College of Engineering and the institution as a whole.

National Society of Black Engineers.

Some participants also discussed their association with the National Society of Black Engineers (NSBE). One participant, who is involved in NSBE, described the organization:

> NSBE is pretty much there to help African Americans succeed. So we do workshops and everything, to talk to companies that come in, to talk to them and give a presentation, give you tips, resume workshops, mock interviews. You get a lot of [NSBE members] that have taken classes before. You have people that actually come back and help with the classes they've taken before. They help with the study groups [and] form study groups. Sometimes, you even actually get a professor to come in and do office hours specifically for them [NSBE] and stuff like that. They're there to help you succeed.

Another participant described his experiences with NSBE:

> NSBE is really good at, you know, we're all kind of in the same boat. We're all Black people in a predominantly White environment. We kind of rely on each other a little bit. It's been pretty good encouragement for the most part.

A few participants mentioned the support and encouragement that they receive from other students in NSBE. They mentioned the importance of being able to rely on a group of other African American students who may have similar experiences as them or whom they can relate to, as African American engineering students. A few participants also referred to NSBE as

"family" (e.g., "my NSBE family"), which shows the extent to which these particular students regard the organization and the relationships they have forged through their participation.

The participants' regard for their experiences with NSBE reinforces Fries-Britt's (1998) findings about the importance of "race-specific" programs in providing culturally supportive environments and promoting attitudes of success. "Race-specific" programs enhance academic and social integration by providing students with beneficial resources (e.g., workshops, interviews, and office hours through NSBE) and a community of high-ability African American students with whom they can relate seek support (Fries-Britt, 1998).

Theme Four: Personal Accountability and Motivation

Students reported that their experiences in a predominantly White college of engineering motivated them to work harder when they fell behind or forced them to realize that they may need to put in more study time than some of their peers. Participants explained that even when they face negativity, difficult times, or do poorly in their classes, they do not let it get the best them. They use the obstacle as a learning experience to do better in the future, or as added incentive to prove their capabilities. One participant explained that his motivation stems from a deeper source:

> …most of the males in my family, they didn't really care too much about school. They were really smart, like street smart and everything, but they just never cared enough about school to actually make it past high school. And I always told myself, "I'm not gonna be that way." I just wanted to be someone to make it out high school. I didn't know anything about college. I'm like, I just want to graduate high school. […] Just being here in college is a big thing for me. Whether or not I do well is dependent on my effort, but I know just being here, I'm honoring my family just by actually being in college. I just want to do well because that's the way I've always been.

Another participant expressed that he found added determination to stay in the program and succeed after meeting and speaking with other Black engineering alumni who had made it through the program:

> The main thing that was keeping me going, was just being like, look, other Black people made it, and it's hard, but you need to make sure that with every generation, that somebody Black makes it somewhere, coming through this program. I was just like, I'm gonna do it.

A few participants also mentioned that they have developed "arrogance," "cockiness," or an "ego," meaning that they tell themselves that they are going to do well regardless of the circumstances. They set themselves up for success not only by studying for exams and doing their homework, but by telling themselves that they will succeed. One participant stated that for him, being in an "arrogant" mindset helps, because "if you start doubting yourself, and you have a low attitude about stuff, then it reflects in the work that you do."

Although this theme is not directly supported by the *Conceptual Framework,* it emerged as significant to the participants' experiences. The attitudes of confidence and self-assuredness expressed by some of the participants seem to reflect concepts of masculinity and attitudes and behaviors that have been associated with men (Harris & Edwards, 2010). In "The Harris Study," participants described contextual influences that shaped, reinforced, and challenged the aforementioned meanings of masculinity and influenced how they expressed themselves as men in their campus environments. Harris and Edwards' findings on masculinity in college men's experiences seem consistent with the way that the participants in the present study expressed how they have developed "arrogance," "cockiness," or an "ego" in order to feel as though they are successful and are reaching a level of achievement.

Additionally, these findings support Moore, et al.'s (2003) explanation of the "prove-them-wrong syndrome" which they found to be consistent with persistence for African American

students in general and African American males in particular. In terms of engineering, Moore, et al. found that the African American males in their study "developed coping mechanisms that manifested into positive vigor in spite of adversity" (p. 67). These students believed that they controlled their academic destiny in engineering. Rather than ignore adversity, the African American males in their study took on a more assertive mindset and a stronger sense of purpose in their academic performance and persistence (Moore, et al., 2003).

Theme Five: Goals Outside of Engineering

A final theme that emerged from the interviews was that each participant made a point to communicate their long-term objectives outside of or in addition to an engineering related career. One student expressed his desire to explore other career opportunities that have been of interest to him, including real estate, as well as an aspiration to move across the country and travel abroad in Europe. Upon further elaboration of his future goals, this student stated:

> Career-wise, I'd like to do consulting for a little bit. I just want to have things on the side; I don't want to just be an engineer. I want to like flip houses on the side, or do radio commercials, or do something, like that I want to keep life interesting, because I don't see myself just settling down and just chilling and just working every day.

Each participant suggested that they have long-term goals outside of engineering, including raising families for some. As one participant asserted:

> I would probably say the biggest thing for me […] is to have a family and just give my kids a better life than I had as I was growing up. […] I think that it's important for me to just be there for my kids because I think that I'll be doing more than my dad did for me. I know they're gonna take it for granted, but I know in my heart that I'm doing something for them that I didn't have myself. So just giving them a better life. That's probably why I'm an engineer.

Several participants also expressed that they would like to volunteer more in the future and give back to their respective communities in various capacities. A few participants expressed that

keeping their long-term goals in mind helps them to stay motivated and focused, and want to succeed in their engineering fields.

Although this theme is not supported by the *Conceptual Framework*, it relates to persistence because students expressed that although they enjoy engineering and would like to hold engineering-related professions at some point during their career, they want to be considered more than just an engineer. A few participants stated that a career in engineering will provide them with the finances, status, or other means to pursue their other long-term goals. Students conveyed that keeping sight of their long-term goals encourages them to persist and do well in their academic coursework so that they will be able to pursue other opportunities in the future.

Summary and Discussion of Findings

The findings above were presented by theme as they emerged from the researcher's analysis of the data. To review, the most salient themes were: (1) pre-college experiences; (2) participation in academic and social networks; (3) institutional programming and organizational support; (4) personal accountability and motivation; and (5) goals outside of engineering.

The first research question in this study asked, "What pre-college factors do participants perceive to have influenced their pursuit of engineering majors?" Pre-college experiences included early interest in and knowledge of the subject area, and familial encouragement and support. Participants suggested that having an early interest in engineering or math, and doing well in science and math courses in high school, encouraged them to pursue engineering as a major and career choice. Support and encouragement from family and family-like structures (i.e.

church) aided participants in making decisions to attend college, pursue engineering, and do well at all levels of education regardless of the specific field that they chose.

The second research question asked, "To what extent do established relationships with faculty and peers and support and encouragement from these sources, contribute to participants' persistence?" Participation in academic and social networks included interactions with peers, faculty, and administrators. Participants stated the importance of having a group of peers that they could study with, ask questions, or just relate to as an engineering student or as a minority in the college of engineering. Students also conveyed the value of having faculty members or staff in engineering who support them, guide them, and consider their interests.

The third research question asked, "To what extent do relationships with familial networks, and support and encouragement from these sources, contribute to the persistence of participants?" As previously mentioned, participants stated that familial support and encouragement were particularly significant prior to the students entering college, and helped participants make the choice to pursue higher education and an engineering major.

The fourth research question asked, "How do participants perceive their academic experiences, being one of few African American males in a predominantly White college of engineering?" Although their motivation may stem from different sources, participants explained that their experiences in engineering have caused them to work harder, overcome obstacles, and succeed academically. Not only are they motivated to do well in engineering, but participants described a motivation to achieve long-term goals in their lives outside of engineering. Some stated that they want to be more than just engineers, while other participants expressed a desire to have a balanced, interesting lifestyle that involves more than solely their work.

The fifth and final research question asked, “How does participation (or lack of) in institutional or other programming geared towards engineering students or towards the academic support of minority students have an effect on participants’ persistence?” All of the participants in the study mentioned that they had previously been or were currently involved in an institutional or departmental program, or an engineering-related organization that was geared towards minority or underrepresented engineering students. Some students discussed their participation in an engineering pre-college summer program, that helped them to forge relationships with other minority engineers and get them acclimated to the campus and engineering environment before the semester started. Several participants also discussed their involvement in NSBE, and how the organization is like a “family,” and fosters the success and advancement of Black students in the engineering department at RU.

Chapter 5

Conclusions and Recommendations

The literature reveals that African American males are underrepresented among students who pursue and earn science and engineering degrees, in comparison not only to White students, but also to their African American counterparts (National Science Foundation, 2006). In order for the United States to maintain global prominence in STEM fields, the literature contends that the STEM field workforce should draw from underrepresented populations (e.g., women and racial/ethnic minorities) who can bring fresh perspectives (Moore, 2006; Sondgeroth & Stough, 1992). In order for employers and companies to attract and recruit this pool of workers, underrepresented populations must first be attracted to STEM fields in K-12 and postsecondary education. Previous research asserts that the race and gender gap for African American males in STEM field exists for multiple reasons reaching back to primary and secondary education experiences, and including a lack of familial support or positive mentors (Hrabowski, 2003; Hrabowski & Pearson, 1993; Moore, et al., 2003). Although disparities exist, studies of high-achieving African American male undergraduate students provide deeper understanding into how students who are academically successful in college are able to maintain their levels of achievement given the range of issues that research shows Black males encounter.

The African American male engineering students who participated in this study were all in their second or third-year, and therefore persisting students. The purpose of this study was to explore the experiences and perceptions of these students in order to consider the factors that have contributed to their access to and persistence in engineering. The most prominent themes that arose from the participant interviews were presented in the previous chapter. The students communicated that some of the themes presented directly influenced their achievement or

persistence (e.g., established relationships with peers, faculty, and administrators; and personal accountability and motivation). Other themes that were mentioned, although possibly not directly credited by the participants to their persistence, were described as significant to their experiences (e.g., support from family; early interest in and knowledge of the subject area; and long-term goals outside of engineering). These themes seemed to be integral to the participants' experiences, and although they may not have been explicitly recognized by each participant, they played a part in their motivation and achievement.

Recommendations and Implications

The present study shows that there are certain characteristics (e.g., early interest in the subject area, personal accountability, motivation, long-term goals) that contribute to the success of African American male students in engineering on a predominantly White campus that may be different from those of students of other racial and ethnic backgrounds. This study also revealed that family, faculty, and peers are significant sources of encouragement and support for this group of students. Although the conclusions reached in this study are in no way generalizable to an entire population, these findings can be used to inform future research that includes a larger population or that takes place at a different type of institution.

Recommendations have been organized into constructs that the researcher considers to be significant based on the research presented in the *Literature Review* and the themes that emerged from the participant interviews. These include: (a) the value of diversity; (b) organizational support; and (c) increased knowledge of best practices to consider.

Value of diversity.

Based on the findings that some African American male participants encountered what they perceived to be negative experiences with faculty and administrators based on race, it is suggested that African American students take a more active approach in seeking out or inquiring about professors or mentors from which they can obtain valuable learning experiences. Although the majority of findings show positive outcomes for students who did have positive interactions with professors, it is important to consider the students who did feel as though they sought out meaningful relationships, but had undesirable experiences. It is possible that these findings may also be prevalent with other students who were not participants in this study.

Administrators, faculty members, and other stakeholders should engage in positive dialogue around diversity, and should explore the value of diversity to the institution and the college of engineering. Diversity of thought, perspective, and experience has large-scale implications for solving scientific, technological, and engineering problems.

One means of influencing the pipeline of African American males (and other underrepresented minorities) in engineering, is for faculty and administrators to serve as mentors or in any other capacity that enhances the experiences of African American male students. Research has suggested various ways in which the role of faculty has a great influence on student outcomes and may play a significant role in the ability of African American males to become motivated and prepared enough to persist in STEM fields. According to the literature, institutional support for African American males should include: encounters with faculty outside of class (Bonner, 2001; Maton & Hrabowski, 2004); mentoring that integrates African American males into the social framework of the university (LaVant, et al., 1997; Spradley, 2001); and strong academic guidance (Maton & Hrabowski, 2004; Moore, 2006). The findings in the current

study support the literature. Participants expressed that their relationships with faculty and administrators outside of class were meaningful and positively enhanced their experiences.

Organizational support.

Research suggests that institutional programming, particularly programs geared towards minority students, is critical in promoting attitudes of success and providing culturally supportive environments for African American males (Fries-Britt, 1998; Hrabowski, 2003; LaVant, et al., 1997; Moore, 2006). The participants in this study discussed the value of the organizations (e.g., NSBE) and institutional programs (e.g., the engineering summer program) that they have been involved in. These experiences provided them with friendships, and feelings of support and encouragement from other Black students.

Participants mentioned that the engineering summer program is only open to certain students and involves a selective application process. Administrators and campus leaders should devise a plan to better acclimate this population of students to the engineering department as well as to the university, one that is open to all African American students. Perceived feelings of differential treatment or feeling out of place or left out, are significant experiences that should be recognized and taken into consideration prior to or once these students have arrived on campus. Social and academic integration into a university is thought to be important to student success (Maton & Hrabowski, 2004), and for students who have already chosen a challenging and demanding academic major, feeling isolated because of race is just one more thing that they have to worry about. Administrators should try to work with these students to possibly lighten at least part of their burden, so that these students can focus on their academic responsibilities and the reasons that they are attending the university.

Increased knowledge.

An educational institution should learn from historical experiences and the best practices of others, should engage in systematic problem-solving, experiment with new approaches, and should ultimately use the ability to transmit knowledge quickly and efficiently throughout the organization (Kezar, 2005). This study does not focus on perceptions of faculty or administrators, so their knowledge and perspectives cannot be extensively addressed. However, in order to better facilitate the persistence of African American males, faculty and administrators should share the knowledge that they do hold with one another, and should be open to expanding their practices to include methods that have been shown by research, other institutions, and other engineering programs to be effective for this population of students.

Administrators should continue to increase their knowledge of the status of enrollment trends, student perceptions, and best practices for recruitment and retention of African American males, as well as other students of color. Faculty and administrators should also become aware of the various programs around the country that have contributed to increases in enrollment and persistence of African American males at individual institutions. Once these programs are recognized, administrators and faculty will be able to tailor these programs to fit their institution or they will be influenced to create their own custom programs.

The Engineering Summer Program mentioned by participants in the current study was created because administrators recognized the need to support and encourage underrepresented students in engineering through early integration into the college of engineering and the institution. Participants described the benefits this program had on their experiences in allowing them to meet other minority students, and become acclimated to the college of engineering and the campus before the start of the semester in the fall.

Recommendations for Future Research

Further research is needed to better understand whether the student perspectives expressed in this study are unique to RU. Future studies should include more students and should branch out to include students from other universities that are similar to RU (i.e. large, predominantly White, research-centered) and other institution types (e.g., small, private, minority-serving).

More work is needed to understand the perspectives of those students who decided not to pursue STEM majors in college, those who started off as STEM majors and changed institutions or moved to a different field, and those students who may have dropped out altogether. Although these may be difficult populations to reach, their perceptions and experiences could shed valuable light on what may have been lacking in their program or institution, or what they would have changed about their experience that might have facilitated their STEM persistence.

Additional studies should include the perspectives of faculty and administrators in STEM fields at universities. This would allow researchers and practitioners to have more sides to the story of parties involved. Comparing faculty and administrator perspectives to those gathered from students, provides the information necessary to create realistic programs and agendas to benefit students, while fitting within faculty and administrators various obligations.

It would be noteworthy for future researchers to delve into the internal factors that affect African American male students' academic performance. This study touched on this with the theme of "personal accountability and motivation," but it might be beneficial to take a closer look at that aspect of students' experiences. Students placed weight on how they view themselves and motivate themselves to succeed and to do better when they fall short of their goals. These characteristics may prove to be very influential for this group of students, and

additional research should further address where this internal motivation stems from and compare findings to students who did not persist in STEM.

Further research should also consider other minority groups (e.g. women, Latino/as, Native Americans). The experiences of these students are also valuable and could shed additional light on underrepresented groups in engineering. While some of the experiences of African American males may or may not be similar to other groups, it is important to account for the range of issues and challenges that each specific group faces and how their experiences allow them to maneuver through engineering and higher education.

Concluding Remarks

This research indicates that further examination of the experiences of African American male students in engineering is necessary. Although this study addresses some of the factors that students attribute to their success and persistence, more research is necessary to deeply explore the feelings, experiences, and perceptions of students at other types of institutions and students who have not persisted in STEM fields. The findings of this study should be reviewed by university, college, and departmental administrators who admit minority students and may have encounters with them throughout their time at the institution. Although research has been conducted in recent decades on minorities in STEM fields and on African American males in higher education, administrators and faculty still remain at a disadvantage. More research is still necessary on African American males in STEM fields, especially research that presents practical applications to address the issues. Many faculty and administrators may still be unaware of the problems that this population faces, so it is crucial that the research that is conducted gets disseminated at an institutional level.

Although issues such as perceived low expectations from faculty and peers and student isolation require continued analysis and attention, the findings in this study suggest that administrators and faculty should devote more time and resources to continue to help African American males succeed in engineering disciplines.

References

Allen, W.R. (1992). The color of success: African-American college students outcomes at predominantly White and historically Black public colleges and universities. *Harvard Educational Review, 62,* 26-44.

Babco, E.L. (2001a). Uphill climb: The status of African-Americans in science and engineering. *Making Strides.* Retrieved from http://ehrweb.aaas.org/mge/Reports/Report1/Uphill.html

Babco, E.L. (2001b). Underrepresented minorities in engineering: A progress report. *Making Strides.* Retrieved from http://ehrweb.aaas.org/mge/Reports/Report1/AGEP/AGEP_report.pdf

Bogdan, R.C., & Biklen, S.K. (2007). *Qualitative research for education: An introduction to theory and methods* (5th ed.). Boston, MA: Pearson Education, Inc.

Bonner, F. A.,II. (2001). *Gifted African American male college students: A phenomenological study* (No. NRC/GT-RM01148). University of Connecticut, Storrs, CT: National Research Center on the Gifted and Talented.

Bowen, W.G., Chingos, M.M., & McPherson, M.S. (2009). *Crossing the finish line: Completing college at America's public universities.* Princeton, NJ: Princeton University Press.

Creswell, J.W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Cuyjet, M., et al. (2006). *African American men in college.* San Francisco, CA: Jossey-Bass.

Davis, J.E. (1994). College in Black and White: Campus environment and academic achievement of African American males. *The Journal of Negro Education, 63(4),* 620-633.

Fries-Britt, S. (1998). Moving beyond Black achiever isolation: Experiences of gifted Black collegians. *Journal of Higher Education, 69(5),* 556-76.

Gahagan, J. & Stuart Hunter, M. (2006). The second-year experience: Turning attention to the academy's middle children. *About Campus, 11(3),* 17-22.

Graunke, S.S. & Woosley, S.A. (2005). An exploration of the factors that affect the academic success of college sophomores. *College Student Journal, 39(2),* 367-376.

Harper, S.R. (2005). Leading the way: Inside the experiences of high-achieving African-American male students. *About Campus, 10(1),* 8-15.

Harris, F., III & Edwards, K.E. (2010). College men's experiences as men: Findings and implications from two grounded theory studies. *Journal of Student Affairs Research and Practice, 47(1),* 43-62.

Hill, S.T. (2002). *Science and engineering degrees, by race/ethnicity of recipients: 1991-2000.* (NSF 02-329). Arlington, VA: National Science Foundation, Division of Science Resources Statistics.

Hines, S.M. (1997). *Factors influencing persistence among African-American upperclassmen in natural science and science-related majors* (Report No. HE-030-071). Annual Meeting of the American Educational Research Association, Chicago, IL. (ERIC Documentation Reproduction Service No. ED 406 898)

Hrabowski, F. III. (2003). Raising minority achievement in science and math. *Educational Leadership, 60(4),* 44-48.

Hrabowksi, F.A. III, & Maton, K.I. (1995). Enhancing the success of African-American students in the sciences: Freshmen year outcomes. *School Science and Mathematics, 95,* 18-27.

Hrabowski, F.A. & Pearson, W, Jr. (1993). Recruiting and retaining African-American males in college science and engineering. *Journal of College Science Teaching, 22(4),* 234-38.

Kezar, A. (Ed.). (2005). *Organizational learning in higher education*. San Francisco, CA: Jossey-Bass.

LaVant, B. D., Anderson, J. L., & Tiggs, J. W. (1997). Retaining African American men through mentoring initiatives. *New Directions for Student Services,* (80), 43-53.

Leppel, K. (2002). Similarities and differences in the college persistence of men and women. *The Review of Higher Education, 25(4),* 433-450.

Manning, K. & Stage, F.K. (2003). What is your research approach? In F.K. Stage and Manning, K. (2003). *Research in the college context: Approaches and methods* (p. 19-34). New York, NY: Brunner-Routledge.

Maton, K.I. & Hrabowski, F.A. III. (2004). Increasing the number of African American PhDs in the sciences and engineering: A strengths-based approach. *American Psychologist, 59(6),* 547-556.

Maton, K.I., Hrabowski, F.A. III, & Schmitt, C.L. (2000). African American college students excelling in the sciences: College and postcollege outcomes in the Meyerhoff Scholars Program. *Journal of Research in Science Teaching, 37(7),* 629-654.

Maxwell, J.A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage.

Moore, James L. III. (2006). A qualitative investigation of African American males' trajectory in engineering: Implications for teachers, school counselors, and parents. *Teachers College Record, 108(2),* 246-266.

Moore, J.L. III., Madison-Colmore, O., & Smith, D.M. (2003). The prove-them-wrong syndrome: Voices form unheard African-American males in engineering disciplines. *The Journal of Men's Studies, 12,* 61-73.

National Science Foundation, Division of Science Resources Statistics. (2006). *S&E Degrees, by Race/Ethnicity of Recipients: 1995–2004.* Susan T. Hill and Maurya M. Green, project officers. Arlington, VA.

Peter, K. and Horn, L. (2005). *Gender differences in participation and completion of undergraduate education and how they have changed over time* (NCES 2005-169). United States Department of Education.. Washington, DC: National Center for Education Statistics.

Powell, L. (1990). Factors associated with the underrepresentation of African-Americans in mathematics and science. *Journal of Negro Education, 59(3),* 292-298.

Rascoe, B. & Atwater, M.M. (2005). Black male's self-perceptions of academic ability and gifted potential in advanced science classes. *Journal of Research in Science Teaching, 42(8),* 888-911.

Sanchez-Leguelinel, C. (2008). Supporting 'slumping' sophomores: Programmatic peer initiatives designed to enhance retention in the crucial second year of college. *College Student Journal, 42(2),* 637-646.

Smith, F.M. & Hausafus, C.O. (1998). Relationship of family support and ethnic minority students' achievement in science and mathematics. *Science Education, 82(1),* 111-125.

Sondgeroth, M.S. & Stough, L.M. (1992). Factors influencing the persistence of ethnic minority students enrolled in a college engineering program (Report No. HE-026-184). American Educational Research Association, San Francisco. (ERIC Documentation Reproduction Service No. ED353923)

Strauss, A. & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Tobolowsky, B.F. (2008). Sophomores in transition: The forgotten year. *New Directions for Higher Education, 144,* 59-67.

United States Department of Education (2007). *Status and trends in the education of racial and ethnic minorities* (NCES 2007-039). Washington, DC: National Center for Educational Statistics.

U.S. News & World Report (2009). *Best Engineering Schools.* Retrieved from http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-engineering-schools/rankings

Appendix A

Informational Letter to Prospective Participants

Fall, 2009

Dear Student:

I am a graduate student at the University of Illinois at Urbana-Champaign in the Department of Educational Organization and Leadership, who is conducting research as part of the completion of a Master's thesis. Part of this research involves asking participants in the engineering department at the University of Illinois to participate in one interview so that I may gain a better understanding of the experiences and opinions that African American male students have while involved in this academic department.

Participation is strictly voluntary. You may also choose to participate in one component of the study and not others. You may opt out of participation at any time without negative consequences or without jeopardizing your relationship with the University of Illinois or the programs in which you participate. All responses will remain confidential and the total time of your participation should last no more than one and a half hours.

If you are interested in participating or would like more information about the project, please contact Courtney Sanders by email at sander45@illinois.edu or by phone at (570)856-3472. If you have any questions about your rights as a research participant, please contact Anne Robertson, Bureau of Educational Research at (217)333-3023 or arobrtsn@uiuc.edu or the Institutional Review Board at (217)333-2670 or irb@uiuc.edu

Thank you in advance for your help.

Sincerely,

Courtney Sanders

Appendix B

Participant Consent Form

Fall, 2009

Dear Student:

This research study is being conducted by Courtney Sanders, a graduate student at the University of Illinois at Urbana-Champaign, who is conducting research as part of the completion of a Master's thesis in the Department of Educational Organization and Leadership (EOL). The Responsible Principal Investigator (RPI) of this research is Dr. Lorenzo Baber, also from the EOL department. Part of this research involves asking participants in the engineering department at the University of Illinois to participate in two interviews in order to gain a better understanding of the experiences and opinions that African American male students have while involved in this academic department.

These interviews will be audio taped with your permission, and the audio tapes and all other information will be kept secure. Participation is strictly voluntary and you may skip questions you do not wish to answer. You may also choose to participate in one component of the study and not others. You may opt out of participation at any time without negative consequences or without jeopardizing your relationship with the University of Illinois or the programs in which you participate. All answers will be confidential and the total time of your participation should last no more than 2 hours.

I do not anticipate any risk to this study greater than normal life and I anticipate that the results will increase the understanding of African American male students' experiences in higher education. The results of this study may be used for a Master's thesis, and a journal article or conference presentation. In any publication or public presentation pseudonyms will be substituted for any identifying information.

For more information about the project, please contact Courtney Sanders by telephone at (570)856-3472 or email at sander45@illinois.edu or Dr. Lorenzo Baber at (217)333-2155 or ldbaber@illinois.edu.

Sincerely,

Courtney Sanders

I have read and understand the above information and voluntarily agree to participate in the research project described above. I have been given a copy of this consent form.

_____

Signature Date

_____

Printed Name

I agree to have the interview audio taped for the purposes of transcription.

_____

Signature Date

If you have any questions about your rights as a research participant, please contact Anne Robertson, Bureau of Educational Research at (217)333-3023 or arobrtsn@uiuc.edu or the Institutional Review Board at (217)333-2670 or irb@uiuc.edu.

Appendix C

Interview Protocol

- Students will be asked to provide demographic information at the start of each interview, which will include: Year in school and engineering focus (e.g,. chemical, electrical).
- Where are you from? What is your hometown/community like?
- When did you realize that you were interested in engineering? (What age? Or in elementary, middle, or high school)
- Why did you choose an engineering field as your academic major? (Were you good in science/math in high school? Just generally interested? Other factors?)
- Did you take higher/advanced levels of math and/or science in high school? (Prompt: What courses? Were they college prep? AP?)
- Did you receive encouragement from others to pursue this field? If so, from whom? (Parents, other family, teachers, counselors, peers?)
- Do you feel like you "fit in" with the engineering program on this campus? (Probe: Are you actively engaged and involved in your classes? Do you ever feel left out? Are you treated differently from any other students?)
- Have you had individual contact with any faculty members? (Describe your interactions. Have these interactions influenced your experience in the program? How?)
- Do you interact with your classmates outside of class? (Socially? Study groups?)
- Have you encountered anyone who has tried to discourage you from entering/ pursuing your major or career goals? (Prompt: Who? How did you handle that?)
- Have you participated in any programs geared towards helping students in math/engineering succeed (i.e. mentoring, summer programs, internships, etc)?
- Have you participated in any programs geared towards helping African American students or students of color succeed in college (i.e. mentoring, summer programs, etc)?
- What are plans upon completion of this program? (Job? Further education? What are your ultimate career goals?)

Appendix D

Participant Demographics

Participant	Hometown*	Major	Academic Year
1	City: population approx. 77,000 77.6% White; 19.5% Black; 0.7% Asian; 1.2% Latino; 0.2% Native American	Industrial Engineering	Sophomore
2	City: population approx. 347,000 43.8% White; 51.2% Black; 2% Asian; 2% Latino; 0.3% Native American	Computer Science	Junior
3	Village: population approx. 17,000 93.86% White;2.48% Black; 2.13% Asian; 2.31% Latino; 0.17% Native American	Mechanical Engineering	Sophomore
4	City: population approx. 2,833,000 42% White; 36.8% Black; 4.3% Asian; 26% Latino; 0.4% Native American	Industrial Engineering	Sophomore
5	City: population approx. 31,500 1.23% White; 97.74% Black; 0.08% Asian; 0.73% Latino; 0.19% Native American	Computer Science	Junior
6	Village: population approx. 70,000 64.5% White; 20.4% Black; 6.4% Asian; 13.1% Latino; 0.2% Native American	Chemical Engineering	Junior
7	City: population approx. 2,833,000 42% White; 36.8% Black; 4.3% Asian; 26% Latino; 0.4% Native American	Nuclear Plasma Engineering	Junior
8	Village: population approx. 20,000 78.14% White; 17.51% Black; 1.57% Asian; 3.05% Latino; 0.10% Native American	Electrical Engineering	Junior

***** Hometown classifications and demographics based on US Census Bureau descriptions